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Tango Panopticon: Developing a Platform for Supporting Live Synchronous Art Events Based in Relational Aesthetics

Michael Edward Stillo
University of South Florida

Tango Panopticon: Developing a Platform for Supporting Live Synchronous Art Events

Based in Relational Aesthetics

by

Michael Edward Stillo

A thesis submitted in partial fulfillment
of the requirements for the degree of
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Major Professor: Adriana Iamnitchi, Ph.D.
Robert Lawrence, M.F.A.
Srinivas Katkoori, Ph.D.

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Dedication

This thesis is dedicated to my family and friends that have supported me all through my academic journey.

To my parents, Tom and Jodi, thank you for providing me the best possible start in life, and for your unending faith and love. Your continual support in all of my endeavors has given me the confidence to succeed and prosper in life. Thank you for pushing me to become the best I could possibly be.

To my best friend, Rebecca Vincent, thank you for providing so much love and support through the good times and the bad. I cannot thank you enough.

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To everyone I am blessed to have in my life, thank you for always believing in me.

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Note to Reader

The graphics in this document representing the web page contain colors which may not be replicated properly in grayscale. The original document is available in the library at the University of South Florida.

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Tango Panopticon: Developing a Platform for Supporting Live Synchronous Art Events Based in Relational Aesthetics

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Abstract

The Tango Panopticon project merges art with technology to create a live and synchronous art experience which is just as much about the participants as it is about the observers. The goal of this project is to create a dialogue between observers of the event in the hopes of creating new social connections where there were none before. This goal is achieved by allowing observers to view the event from anywhere around the world on a computer via the internet and participate in a dialogue with other users on the website.

The other objective of this project is to create a multimedia internet platform for other art projects to use. Other artists that are interested in hosting their own live synchronous event will be able to use the platform we have created and customize it to the specific needs of their project.

Chapter 1: Introduction

The premise of this thesis is based on the Tango Panopticon project, an interdisciplinary project between the College of Engineering and the College of the Arts at the University of South Florida. The goal of Tango Panopticon is the merging of Social Sculpture and Social Networking in order to bring a new level of interaction between participants in Social Sculpture events.

1.1 Relational Aesthetics and Social Sculpture

Esthétique relationnelle - in the original French - is the "Aesthetic theory consisting in judging artwork on the basis of the inter-human relations which they represent, produce or prompt" [1]. This term, Relational Aesthetics, was coined by Nicolas Bourriaud in his book "Esthétique Relationnelle" published in 1998. In this book he analyzed the relational art of many artists including the works of Joseph Beuys. Beuys' work has formed the basis of the "Social Sculpture" art movement, which began in the 1960s [2]. Beuys "took the idea that sculpture could be made out of any material and expanded the range of material to include social interactions" [3]. This "Social Sculpture" art movement serves as the inspiration for the Tango Panopticon project.

1.2 Tango Panopticon

The Tango Panopticon project is

> [A] worldwide sensual incursion on Video Surveillance... It involves dancing tango where tango is not expected. In the public realm this acts as a gentle intervention, a brief sensual interruption of the normal business of life. It surprises people and generally leaves them with a smile. [4]

This explains the live aspect of the project, and how people perceive these Tango events when they see them happening in a public space.

The other aspect of this project is based in technology that facilitates social networking and social interaction, providing the means by which social sculpture is brought about.

> On the web, the performance is re-contextualized in a critical framework relative to the history/culture of the specific geographic place where the dance takes place, and also related to the history/culture of tango. ... In this way the project has two very different sides, one on the street that is a sensual celebration, and one on the web that is a social enquiry—often political [4].

The description of the project explains how video surveillance plays a part in the work:

> So what is this surveillance aspect about? As the product of immigrant culture Tango has a history tangled in issues of labor, identity, and the struggle for individual expression and rights. In many ways this beautiful dance that we love is a manifestation of that struggle—at the same time

> that it is a profound and intimate communication between two people (who are not all likely to be thinking anything even remotely political). This event ... gets at this dual nature of tango. "Tango Panopticon" is simultaneously an international affirmation of individual rights in a world increasingly monitored by unseen government and corporate powers, and a worldwide dance party celebrating the sensuous. [4]

The Tango Panopticon project is based on an idea that seeks to involve those observing the Tango events in a social discourse that allows comments and ideas to be freely exchanged between observers that may not otherwise have ever interacted with one another. The Tango Panopticon project seeks to merge separate Tango events into a cohesive event connected via live streaming video as well as other technology. Nicolas Bourriaud believed that video is becoming an integral part of art and that modern art must begin to follow suite with modern technology, specifically modern video technology. When Bourriaud published his book on relational aesthetics in 1998, the modern video technology of the day was the VCR. "The maneuverability of the video image is conveyed into the area where images and art forms are handled and manipulated. The basic operations we carry out with a VCR (rewind, hold, freeze frame, etc.) are now part of the array of aesthetic decisions of any artist. This applies to channel-flicking, for example. Like films, according to Serge Daney, exhibitions are becoming

> disparate, zappable little programmes, where the visitor can make up his/her own itinerary. ... As we have seen, the work of art is no longer presented as the mark of a past action but as the announcement of a

forthcoming event (the “Trailer effect”), or the proposal of a virtual action. [1]

Pedestrian passersby who happen upon a singular Tango event will have a singular viewpoint of a singular event at a singular location. In contrast, the web based interface of the Tango Panopticon project, which serves as the part of the basis of this thesis, must meet the requirements set forth by Bourriaud for a “zappable little programme.” Internet passersby must have the ability to choose their own vicarious viewpoints of the multitude of Tango events around the world, and elect which Tango locations they wish to watch, as well as how they wish to watch them.

Modern technology plays a vital part in the Tango Panopticon art project by expanding the possibilities of social interaction and modern art. Developing the tools and technology involved in facilitating these social interactions is the basis for this thesis.

1.3 Requirements

We are interested in allowing involvement by as many people as possible with this project. There are many technological aspects involved in creating this “zappable little” interface. The requirements put upon the technological side of the project include providing the following:

- the ability to watch any event location from any other location in the world
- the ability to share one’s comments with others
- the ability to see the comments that others share
- the ability to visualize the spatial relationship between observers and participants
- a method to keep a record of the event

- a method to facilitate social interactions between event observers that might not otherwise have been possible

These abilities will expand the spectrum of social interactions available to participants in these events beyond any that have previously been available with respect to the Tango Intervention and Tango Panopticon projects. According to Robert Lawrence, there have been no other projects that have pushed the boundaries of Social Sculpture mixing with Digital Art as Tango Panopticon has [4].

Many decisions needed to be made regarding how to facilitate these requirements. In order to allow people across the globe to see these live events in the not-too-distant past would have been a daunting task, but with the advent and widespread adoption of smartphones by the general public, we have the ability to do just that. We can leverage the video features of current mobile phones together with the ubiquitous presence of high speed cellular networks to turn every person into their own video broadcast location.

The contributions of this thesis are in the design and implementation of a platform that allows a grass-root type of surveillance: passersby who happen to be at a Tango Panopticon location can stream video from their own smart phones. Internet passersby will be able to watch what happens at all Tango Panopticon locations. And everybody will be able to communicate via well-known social media tools, with the project website as the meeting point.

Through merging art and technology and providing these various social interfaces, we can facilitate a new and exciting social discourse involving many forms of expression including video, audio, dance, text, and music.

Chapter 2:
Architecture and Implementation

The main focus of the Tango Panopticon project is to allow the community-at-large to easily be a part of a live art event, without requiring specialized technical knowledge. The architecture of the supporting system is designed in such a way as to allow as many avenues of participation as possible. This is achieved through both custom methods as well as leveraging existing technologies with established user bases.

The requirements for the project are:

1. Allow passersby to participate in the event by:
    - 1.a. Streaming live video from their mobile phones
    - 1.b. Sharing their location to help identify where the videos are coming from
    - 1.c. Engaging in interactions with local and remote project participants
2. Allow remote participants to be involved in the event by:
    - 2.a. Following the event from the web page of the project (by watching live videos, seeing online conversations and interactions, etc)
    - 2.b. Sharing their own comments about the event
3. A reliable system that can sustain high load in terms of:
    - 3.a. High number of page views on the web server of the project
    - 3.b. High volume of recorded interactions
    - 3.c. That reduces the dependence on singular 3rd party services
    - 3.d. That reduces the dependence on critical components

4. A web page suitable for galleries and museums
5. Monitoring and filtering of live interactions
6. Recording all data related to the project: videos, locations from where videos were transmitted, online conversations, etc.

We identified the following functional components for our system:

1. Video streaming
2. Mobile application
3. Text updates service
4. Web server
5. Web pages for galleries and the public
6. Provisioning hosting resources

The following two figures show the architectural setup of the system. The first figure (Figure 1) depicts the system from the user's point of view and second shows a more realistic and complete point of view.

Figure 1 shows that when a user logs on to the Tango Panopticon website, all of the data that has been aggregated by the Tango Panopticon Server is displayed on the web page in an easy to access manner. The Tango Panopticon Server gathers data from all of these services through the internet and organizes them for the user enabling them to view live video streams from around the globe all on one web page.

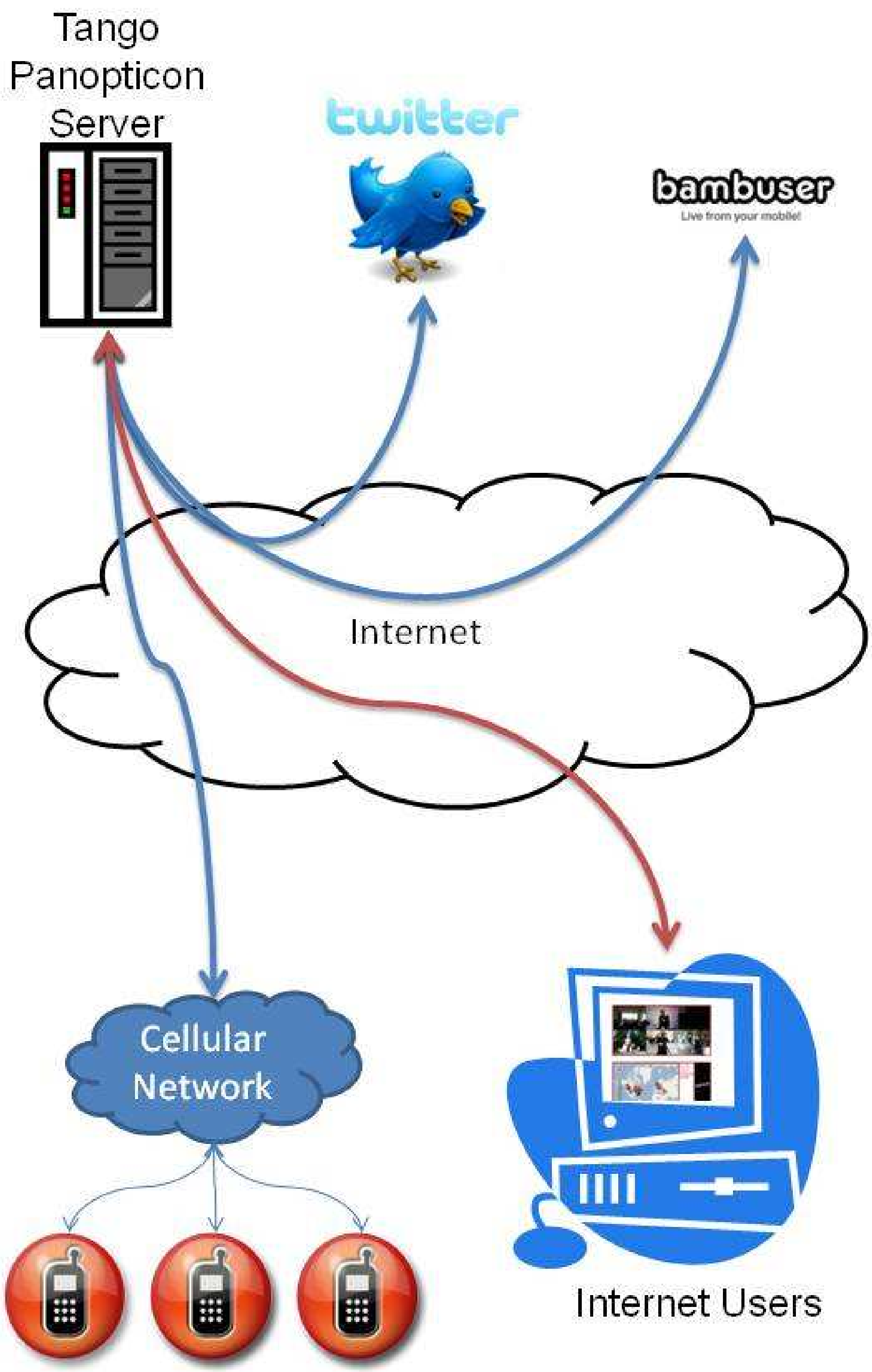

Figure 1. System Architecture (User's View)

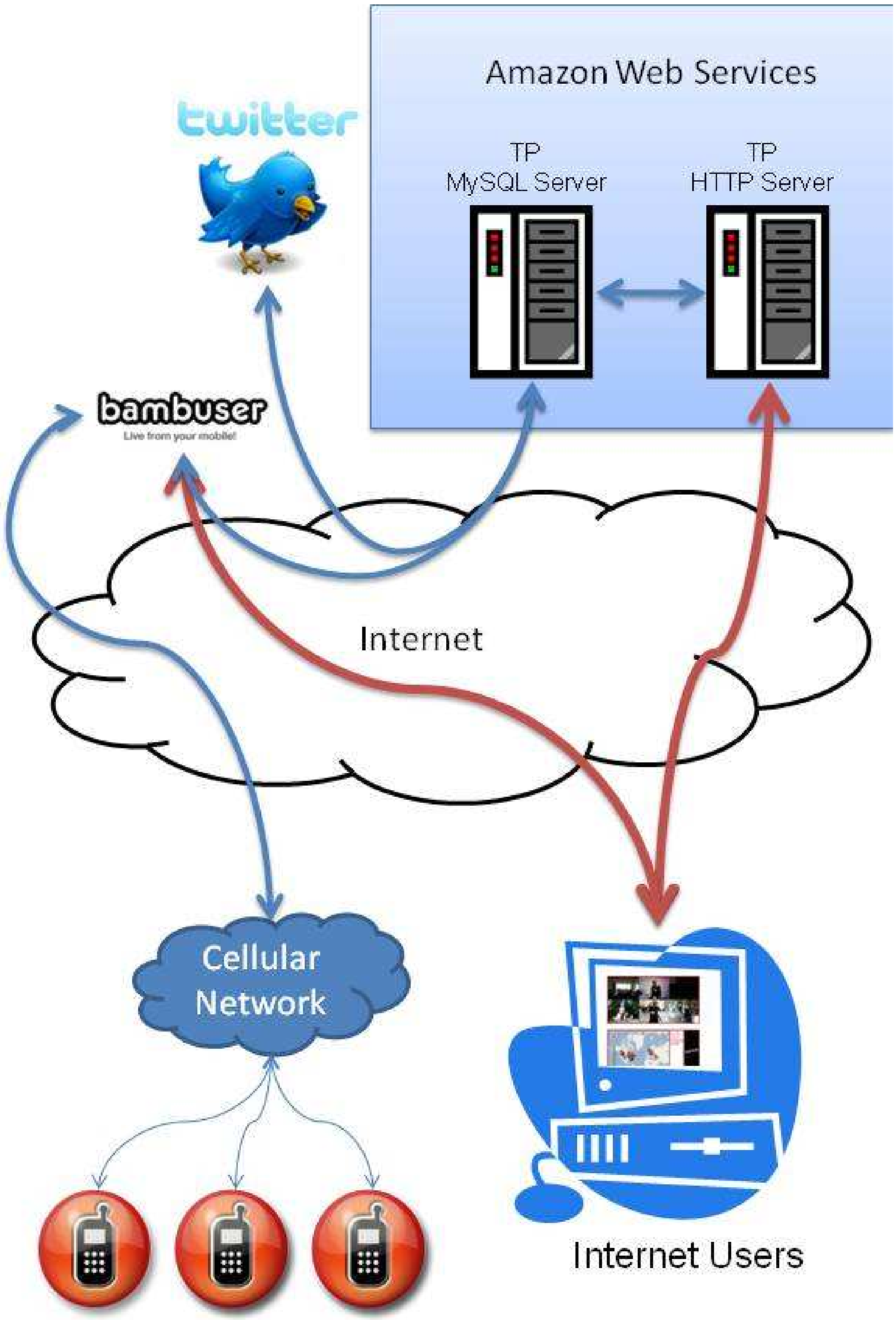

Figure 2. System Architecture (Complete)

Figure 2 shows the finer intricacy of the system that is not presented or immediately discernable to the user. The Tango Panopticon MySQL server gathers data from Twitter and the Video Services (shown by the Bambuser icon) and stores them in a database for use by the Tango Panopticon HTTP server. The HTTP server in turn aggregates this information and presents a single web page to the user with embedded video objects from the Video Services. This video data is first sent from the participant's cell phones to the video service (shown by the Bambuser icon), processed, and then embedded into the web page generated by the Tango Panopticon HTTP server.

In the following we discuss our implementation decisions for each component.

2.1 Video Streaming

One of the lynchpins of the event is the ability of both local and remote observers to feel as if they are experiencing and participating in the event regardless of their physical location across the globe. The main method used to achieve this goal is allowing video and audio to be broadcast from each location and to allow anyone to watch the event unfold in real time. Hence, participants should be able to use their own mobile phones to stream live data. Giving passersby the ability to share these events from their own point of view makes them feel part of the event. All of this is accomplished without any intense involvement on the part of the users as they are free to come and go as they please and are not bound to broadcast for any substantial or predefined length of time.

In order to fulfill the requirement set forth in 1.a of the requirements list, this project leverages two video streaming services available for free, Bambuser and Qik. Utilizing both Bambuser and Qik addresses the requirement for reliability (requirement

3.c), as it allows us to load share between the two services as well as default to one if the other experiences an interruption in service.

The video services Bambuser and Qik (known hereto as the “video service”) provide are free to use and provide ease in the generation of user based content. The video service’s mobile device based application streams audio and video data to the video service’s servers where it can be transmitted live to any Adobe Flash capable device such as a desktop or notebook computer. The video service provides an API to allow their video to be embedded into other websites by username and video ID number. They also provide RSS streams for each user so that an account can be monitored for any new, live transmissions.

The integration of these services into our system requires the following. First, we need to facilitate the seamless setup of an anonymous video service account and registration with our service to streamline the ability of the general public to participate in the event. This approach also allows passersby to participate with absolute anonymity if they so choose. Second, we need to utilize the video services’ RSS feeds to monitor the broadcasting status of our set of pre-existing video service accounts. The video services monitoring process on the Tango Panopticon server checks the RSS feeds of registered accounts and adds any new live feeds to the Web Services whenever one comes online. Third, we use the live video identification numbers that the RSS feeds provide to display the videos on the web page, leveraging AJAX, allowing a seamless web experience.

2.2 Mobile Application

In order to record the location from where videos are streamed (requirement 1.b) we built a custom application for Android Operating System based mobile devices.

From the application development standpoint, Android OS is an open-source event-driven environment. Android applications are written in Java and there are also many useful packages available for the Android OS for network communication and for gathering information related to the GPS-based physical location of a device. All of these factors combined influenced the decision to leverage the Android platform to host our custom mobile application.

Our custom Android application has the following capabilities:

- It provides location-based services utilizing Google Maps to allow participants to visualize the locations of other participants.
- It sends live text status updates to the Tango Panopticon Server.

An issue that the mobile application may suffer from is a lack of GPS signal as GPS only works outdoors, but this is not a problem for the Tango Panopticon events as they typically take place outdoors. The live text update feature of the application is for direct, integrated communication with our art platform that does not require the use of a third party service like Twitter.

However, these applications are limited to only Android phones, which cover 28% of the smart phones market. Android phones are the second most wide spread mobile phone platform behind Research In Motion's Blackberry platform [5]. The custom Android application is comprised of 418 lines of code. We chose the Android OS as the platform for our mobile application because of its open nature. There is a great deal of source code available and Google has provided excellent developer support that fosters an environment of open creativity.

These capabilities will allow users to interact with others around them who are also participating in the Tango Panopticon event. Users will be able to go to the website to see where other participants are located as well as what they have to say about the event.

2.3 Text-Updates Service

Another way to allow passersby to participate in the event is by allowing them to share information and experiences via a text-based medium. There are many well established methods for using text to share one's thoughts and feelings. This project integrates well established services with broad user bases with custom methods that preserve the anonymity of those participating. This project integrates with Twitter to leverage the Twitter user base to enable ease of participation.

Twitter's servers receive up to 2.5 million updates, called "tweets," every day [6]. These tweets contain many elements that are useful to the purposes of the Tango Panopticon project. "Hashtags" may be included in a user's tweet in order to identify the topic of a tweet. These hashtags consist of a pound sign (#) followed by a maximum of sixteen characters that identify the topic (e.g., #android or #tangpan) of a tweet which enables the tweet to be searched for much more easily.

Another important element of a tweet is its assigned "Tweet ID" which is a number generated for each tweet by Twitter's servers that corresponds to the order in which each tweet is received. This allows search requests sent to the Twitter service to exclude tweets received before or after a specific tweet ID or certain date and time. Providing a hashtag and a tweet ID to the Twitter search service allows Twitter's servers to find any new tweets that were received after the last search request.

We use the hashtags and the tweet IDs provided by Twitter to integrate this service into the Tango Panopticon project. Specifically, the increasing tweet IDs allows the Tango Panopticon servers to find and receive new tweets without having to sort through old ones to detect copies. The hashtags allow the participants of the event to tag their tweets for indexing by our Twitter monitoring service. Twitter provides an extensive search API to allow developers a way of searching and indexing tweets by their content, tweet ID, and date, among other things. We leverage both the hashtag content of tweets and the tweet ID of our most recently received tweet to search for any new tweets that have been posted since our last search API call.

Twitter allows applications to poll the search API at least once every 30 seconds without the API server rate-limiting the calling application. Authenticated search API calls may poll at a frequency higher than twice per minute, but the maximum search rate remains undisclosed by Twitter.

We developed a service that polls the Twitter search API every 30 seconds (the minimum amount to avoid rate limiting). There are two parameters included in the search API query: the project's hashtag (#tangpan) and the tweet ID of the last received update. This request returns an XML encoded string containing all related tweets that match the search request parameters and their related properties such as usernames, location data, and tweet IDs.

Along with integrating the Twitter service, this project also implements a custom "Shout Box" on the project's web page. Our "Shout Box" allows Internet passersby to leave comments or ideas on the web site for others to read and respond to. The visitors to the website need only enter text into the box with the option of entering a screen name in order to be a part of the project. The messages entered by users into this "Shout Box" are compiled with the indexed tweets then presented in stream-of-consciousness form on the web page and allow a continuous and anonymous dialogue to develop between users viewing the web site. By utilizing both Twitter services and the custom "Shout Box", requirements 1.c and 2.b are fulfilled.

To summarize, our platform integrates three tools for leaving text-based comments: First, people with Android smart phones can download (from Marketplace) an application that allows them to post comments on the project web page. Second, anybody with a Twitter account can tweet; tweets hashtagged #tangpan are posted on the project web page. Third, a shout box is available on the project web site to even more facilitate communication.

2.4 Web Server

The Tango Panopticon project utilizes the Apache web server software to host all of our hypertext documents on the internet. According to Netcraft's February 2010 Web Server Survey, over 54.46% of the 200 million sites surveyed utilized the Apache web server framework to host their content. [7] The Apache web server software is also open source which falls in line with our preference for open source platforms.

The data repository backend for the web server is hosted using the MySQL Relation Database Management System (RDMS), an open source and very robust RDMS that many websites, including YouTube, Flickr, and Wikipedia use. [**8**]There are many other HTTP server software and RDMS packages available, and we chose Apache and MySQL because of their robust and proven nature. The operating system underlying our web server is Linux, again chosen for its robust and open nature.

Combining Linux, Apache, and MySQL together with the power of the PHP web scripting language leads us to our complete web application stack. This LAMP stack provides the power and flexibility that this project requires.

2.5 Resource Provisioning

In order to avoid a potential slowdown or interruption in services during the live Tango Panopticon event, a method for handling an unpredictable amount of internet traffic is required. For this, we turned to scalable internet hosting in the cloud. While many companies offer on-demand hosting, Amazon Web Services requires no upfront costs, and offers many services that allow ease of scalability.

Amazon Web Services provides a unique combination of low cost and flexible services. Their Elastic Compute Cloud (EC2) allows "instances" to be rented on a per-hour cost basis for a current price of $0.085 per hour [9]. An instance equates to one physical computer with a network connection and pre-selectable amount of computing and storage resources available to it running an Amazon Machine Image (AMI). An Amazon Machine Image is built either on a user's local machine, or may be built on top of an existing Amazon Machine Image. This machine's operating system, applications, and data is then bundled using Amazon's development tools and uploaded to Amazon Web Services. This machine image can then be booted on any number of instances and one can build a scalable web hosting cluster in a matter of minutes.

CloudWatch is another Amazon Web Service that enables resource utilization monitoring on Amazon Machine instances. It can be enabled on a running instance to monitor the resource utilization of each particular instance at a rate of $0.015 per hour in addition to instance costs [**9**]. An Elastic Load Balancer can be used to balance internet traffic across multiple instances running Apache web server images at a rate of $0.025 per hour [9]. Amazon also provides services apart from their Elastic Compute Cloud which will serve important roles for our project. Amazon's Elastic Block Store (EBS) is a persistent and scalable storage medium hosted on Amazon's servers, unlike EC2 instances which cannot retain data after being terminated. Elastic Block Store can be utilized at a rate of $0.10 per GB per month [9].

We leverage the power of Amazon's Web Services in a number of ways. The Tango Panopticon web servers are hosted on Elastic Compute Cloud servers utilizing Amazon CloudWatch. This allows the load on each web server to be monitored individually and allows more web servers to be automatically started when average load begins to increase across the servers. All of these servers will be load-balanced by Amazon's Elastic Load Balancing Service. This service will distribute the internet traffic load evenly across the servers within the hosting group.

The MySQL database server will also be hosted from within Amazon Web Services. This MySQL server will both provide data to the Apache web servers, and will also gather the information from the video, text, and location services. There will be two identical database servers, one active and one running as a hot spare in the event that the first experiences a service interruption. Amazon's Elastic Block Storage will serve as the storage location for the database data as well as the web page data for the projects.

Figure 3 below shows the relationships between HTTP servers, MySQL servers and the Elastic Load Balancer.

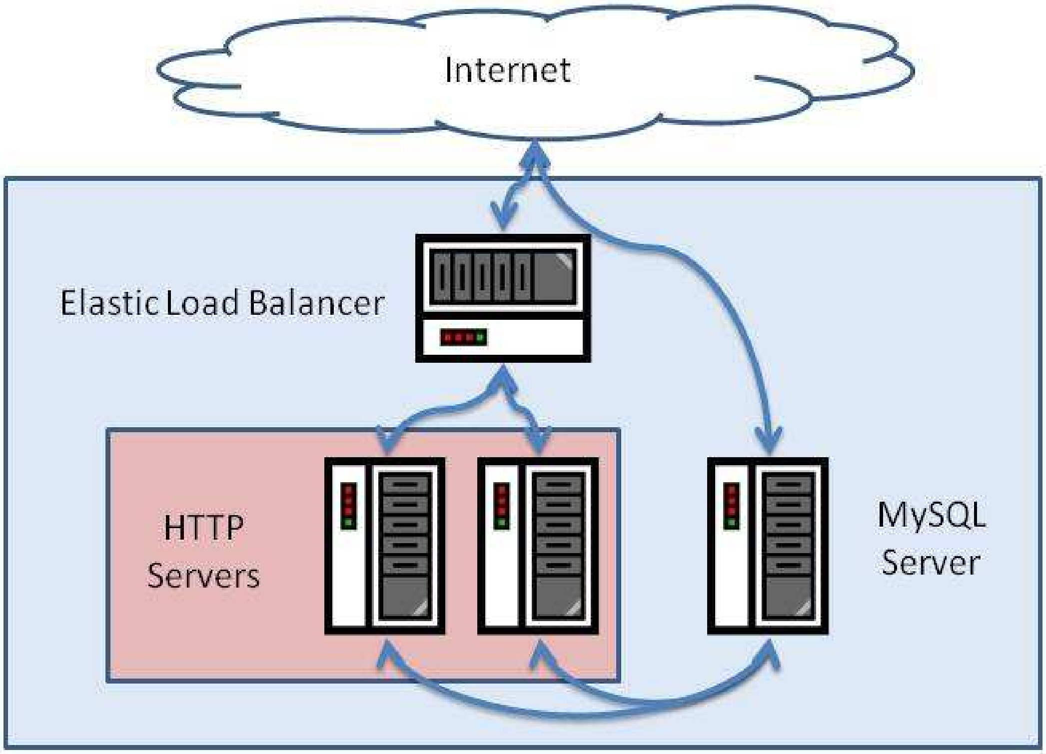

Figure 3. Tango Panopticon Architecture on AWS

Chapter 3:
Background: Challenges of Streaming Video

There are many technical challenges associated with streaming live video and audio data from a mobile phone and broadcasting it out to the internet. There are 5 main phases to the broadcasting process: recording, uploading, transcoding, broadcasting, receiving. These processes, along with their associated challenges will be explained in the following sections.

3.1 Recording

The recording phase takes place on the mobile phone itself. The data from the camera is collected and stored in local temporary storage. The full resolution of the camera generates far too much information to stream live over a cellular connection. A standard 5 megapixel camera in a current smartphone (Motorola Droid) with 5 million pixels at 24 frames per second of actively moving dancers will generate around 27 megabits of raw information per second [10], while the average 3g cellular connection offers at most 2 megabits per second of bandwidth while the device remains motionless. If the device is moving or being carried by a person, as little as 384 kilobits of bandwidth may be available.

Cellular carriers may, at their discretion, lower the maximum amount of bandwidth available [11]. In order to stream smooth video over a cellular connection of at most 384 kilobits per second with full motion, a lower resolution of video must be chosen. This lower resolution will be somewhere in the range of 176 pixels wide by 144 pixels high for a total of 25 thousand pixels at 24 frames per second [10]. Other factors that may improve or degrade the quality of streaming video include compression techniques and limits of the processing power available in the smartphone itself [12]. All of these choices about desired frame rate and resolution are made on the phone before broadcasting and assume that signal strength will remain constant.

3.2 Uploading

Uploading data from the phone is the second bottleneck and offers various unique challenges. The video being recorded by the phone and stored locally must be sent over the cellular connection to the video service's servers. The technological hurdle that must be overcome is gracefully managing variability in network bandwidth and signal strength. The video being recorded is set to perform at a certain level given a certain amount of bandwidth. Ideally the video is broken into TCP packets and sent over the cellular connection to the servers, but sometimes the bandwidth available cannot carry the amount of data that is being recorded. Bambuser has developed a unique way of managing this problem by gracefully reducing the amount of data that the application sends over the cellular connection using what Bambuser calls "adaptive data throughput". Bambuser's "adaptive data throughput" combined with their use of the MPEG-4 codec allows smoother video at a higher frame rate without a complete number of frames being uploaded. This adaptive system puts a priority on audio data uploading in order to maintain the integrity of the audio stream [13]. Utilizing this adaptive data throughput reduces lag to the Bambuser server by selectively choosing not to upload certain frames of video, putting a priority on the most recently generated video frames. The frames that are selectively dropped are stored locally on the phone until the broadcast is complete.

Once the mobile broadcast has ceased, the data (or frames) that were not sent to the Bambuser servers during the broadcast are then uploaded. These frames are assembled into the broadcast to produce a video of much higher quality that is available on demand at a later time.

Both the recording and the uploading phases of mobile video broadcasting are handled by the Bambuser application on a user's phone. This application connects to the Bambuser Service hosted on Bambuser's servers for the remaining three phases of broadcasting video from a mobile phone.

3.3 Transcoding

Once the raw video data has been received from the mobile phones, it must be encoded and compressed in a format that can be easily viewed on the internet. Adobe's Flash Video (FLV) is used commonly to display video on websites including YouTube and Google Video. Flash video is widely supported across computing platforms including Microsoft's Windows Operating System, Apple's Mac OS X Operating System, and the Linux Operating System.

Bambuser utilizes the Flash Video standard to broadcast videos over the internet. With Flash Player 6 and above, a broadcast application (a Shockwave Flash file) can be created with customized settings for encoding audio and video from a camera or other audio/video data source on a computer or server [14]. Bambuser has utilized this technology and leveraged it to work with a remote camera and microphone attached to a mobile phone as its source for data. The Bambuser service provides the processing power to encode videos into Flash Video format, the storage space to store these videos, and the bandwidth to make them available for viewing.

3.4 Broadcasting

The encoded video data that is generated by the Flash Video broadcast application is again broken into TCP packets and sent over the internet to users that wish to view a particular video.

3.5 Receiving

Adobe's Flash Video Primer contains the following description of the relationship between the client and server during Flash Video playback. "The most complete, consistent and robust delivery option is to stream video and audio files from a server running Flash Communication Server. In streaming, each client opens a persistent connection back to the video server, and there is a tight relationship between the video being delivered and the client interaction. This approach lets you deliver features such as bandwidth detection to serve up the right size video, quality of service metrics, detailed tracking and reporting statistics, and a whole range of interactive features along with the video experience [14]."

Chapter 4:
Experimental Results and Limitations

In order to verify that the Tango Panopticon servers are stable we ran various network tests to verify that the system will be able to handle internet load that far exceeds our expected amount of visitors to our site. Tango Panopticon's organizer, Robert Lawrence, noted that we could expect around 100 viewers of the web page at any given time [**3**]. We chose to simulate ten times that amount of traffic in order to assure ourselves of a safety factor of ten.

Figure 4 below shows two phases of testing on the Tango Panopticon HTTP server during load testing. The first 10 minutes along the line graph shows one Amazon Machine Image putting load on the Tango Panopticon HTTP server. The graph increases after 10 minutes is showing a second Amazon Machine Image beginning to put additional load on the HTTP server. One server alone generated the load of 1000 individual users making a request for the Tango Panopticon web page with each user requesting the page approximately 50 times per second (1000x50). These test parameters far exceed the predetermined 100 user load with seldom page refreshes.

Our system performed with no problems at the 1000x50 user mark and we wanted to ensure that this was not the limit of the system, so we began load with the second server to ensure that we had resources to spare on the Amazon Machine Images. The steep increase in utilized resources proves that the machines perform well past our test metrics.

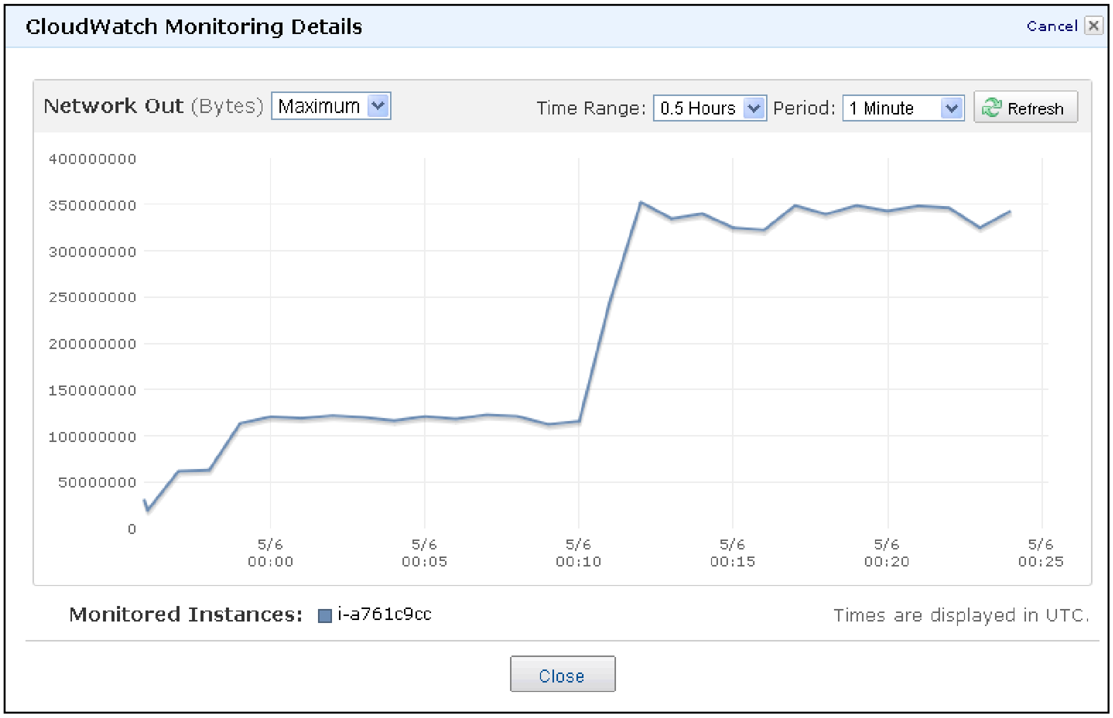

Figure 4. Tango Panopticon HTTP Server Load Test Outbound Network Traffic

Figure 5 shows the same time frame as the testing described above. This graph is showing the processing resource utilization during the load testing. We were able to push the processing load this high only because we requested non-cached versions of the Tango Panopticon web page for each request. This demand for non-cached page content forced the server to re-interpret the PHP script on every web page and generate the HTML code individually for each request.

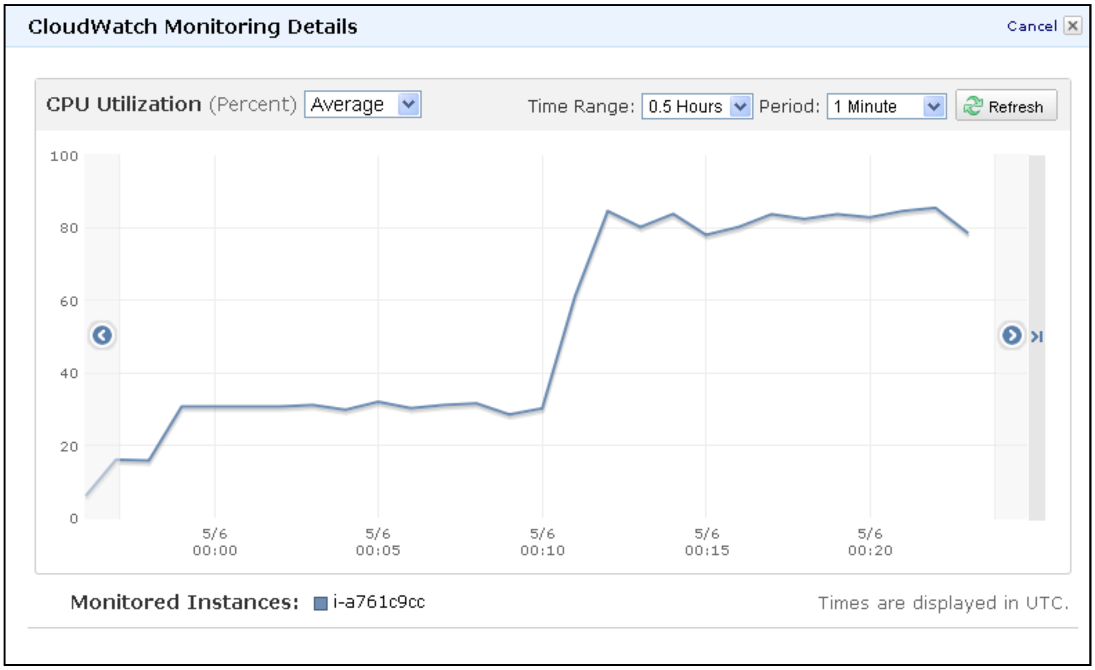

Figure 5. Tango Panopticon HTTP Server Load Test Processor Utilization

Chapter 5:
Event Results

We have held two successful events utilizing this multimedia system platform.

5.1 Tango Panopticon in the ElectroSmog Art Festival

On March 20th, 2010 we held our first full event that utilized all aspects of our system. The Tango Panopticon art event was accepted in the ElectroSmog Art Festival that is hosted in Amsterdam. This festival concentrates on the new concept of Sustainable Immobility as a critique to our Hyper Mobile civilization and its "ecological unsustainability" [15].

During the performance, 4 video streams were sent to our platform. We experienced a small service interruption (minutes) because of an invalid entry into our database by a misinformed user. This problem was easily fixed and the rest of the system worked perfectly.

5.2 May 1, 2010

The full Tango Panopticon event was held on May 1, 2010 starting at 3pm Eastern Daylight Time. Beginning around 2pm Eastern Daylight Time live video streams began from around the globe. The first location to begin broadcasting was Port Townsend in Washington. The website displayed an event time of "7-8 Greenwich Mean Time" which for some participants may have been confusing. The belief among the team is that there were some misunderstandings regarding what time the event was to be held in their timezone as two streams began at 2pm EDT (one hour early as shown in Figure 6), most began at 3pm EDT (as shown in Figure 7), and one more began at 4pm (one hour late). It is also interesting to note that some locations continued streaming video of their local tango event long after the one-hour interval expired: for example, the event held in Portland, Maine lasted for well over 3 hours starting at the beginning of the event and lasting further into the evening.

5.3 May 1st Event Statistics

During the event, the website had over 100 unique visitors from 13 countries across 4 continents. The average time that people spent on the website was three and a half minutes. We received a total of 10 live video streams from around the world including South Africa, Germany, and the United States.

Our server load during the event stayed minimal and there was no noticeable degradation in performance at any point. Figure 8 shows the outbound network traffic from the HTTP server for the hour of the event and the two hours preceding. There is a notable increase in the network traffic right before the event starts at 3pm. Figure 9 shows the inbound network traffic to the HTTP server for the hour of the event and the two hours preceding. This graph also shows a notable increase in inbound network traffic to the server during the event.

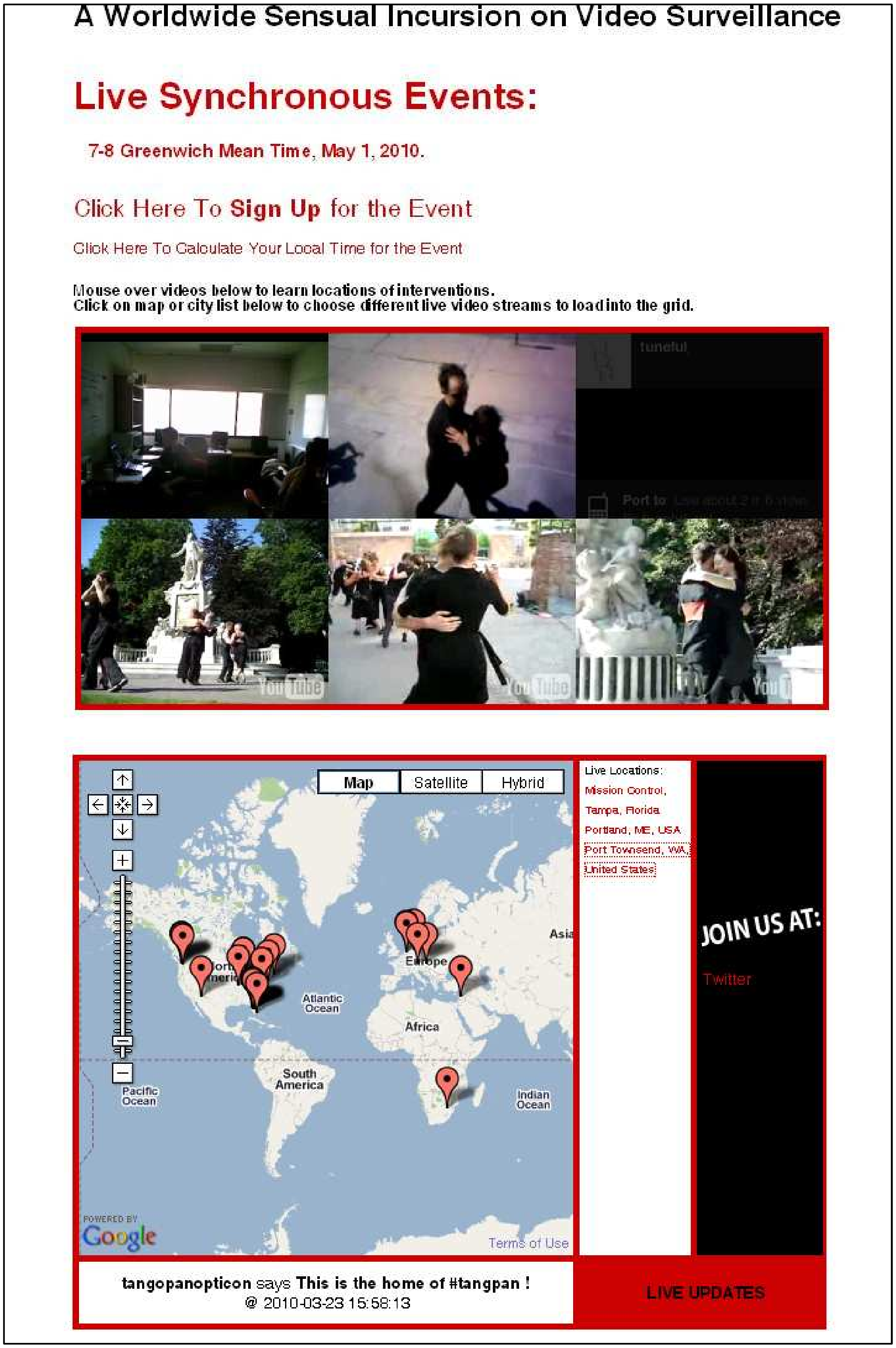

Figure 6. Screenshot of Website, May 1, 2010, 2:00pm

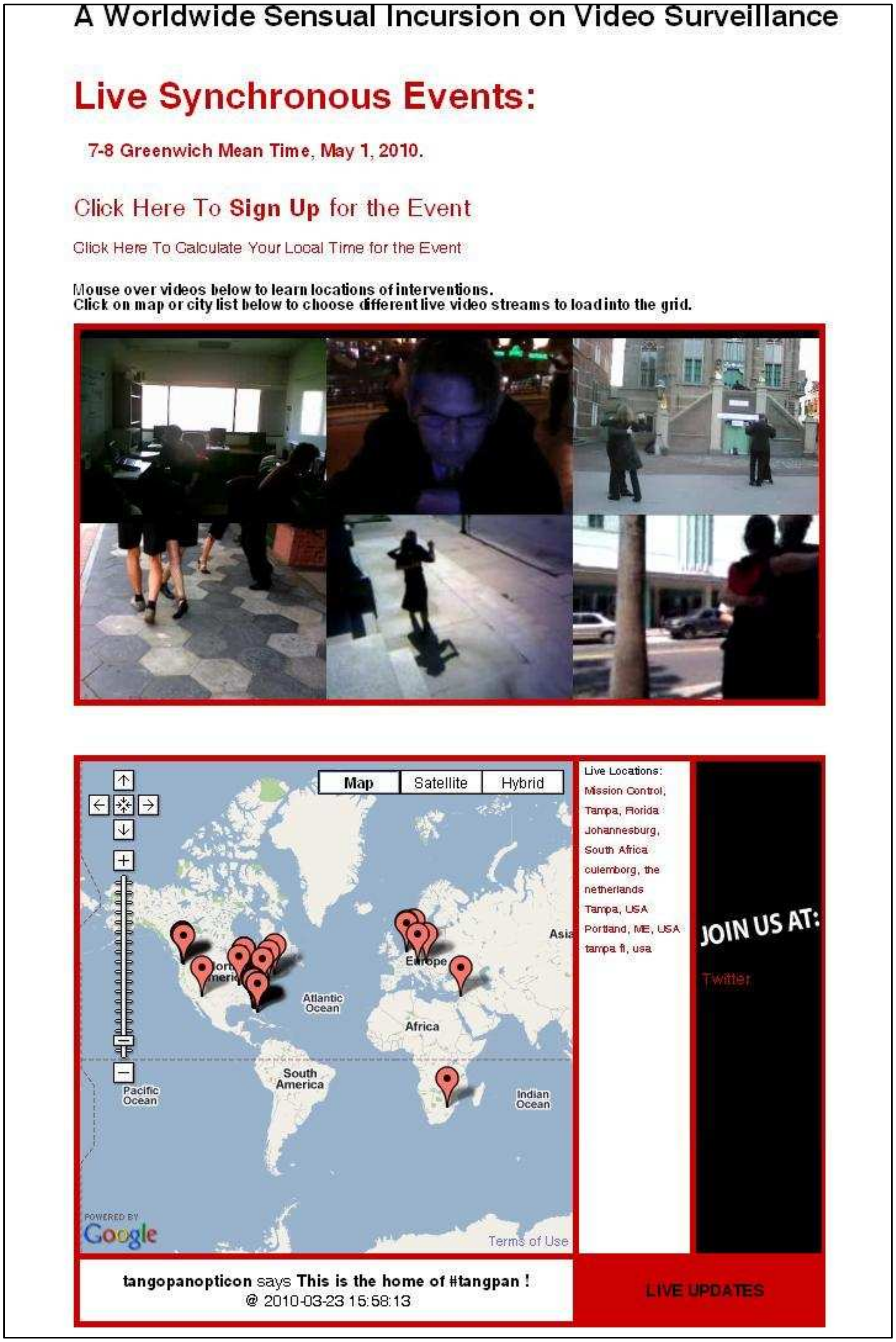

Figure 7. Screenshot of Website, May 1, 2010, 3:15pm

Figure 8. HTTP Server Network Traffic (Outbound)

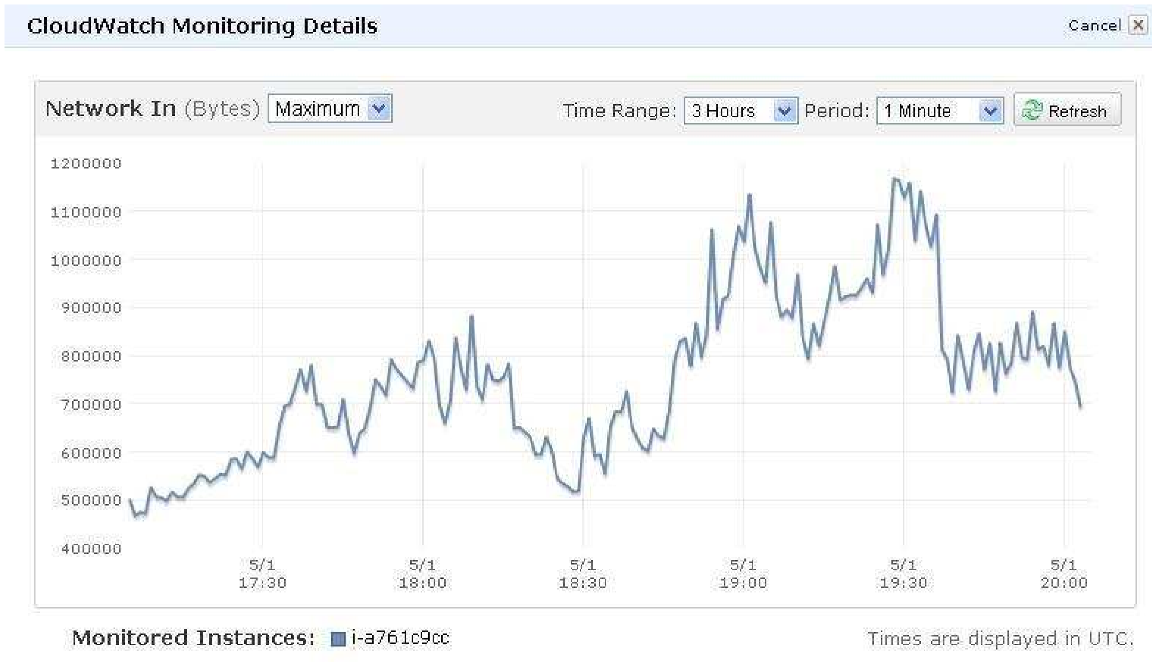

Figure 9. HTTP Server Network Traffic (Inbound)

Chapter 6:
Related Work

Amazon has created a platform for hosting multi-continent synchronous projects with their Web Services. Their service has hosting points concentrated around the globe in America, Europe, and Asia that are available to host user generated content. The ability to host user generated content on their servers around the world allows works like the Tango Panopticon project to operate effectively.

There are other services available in the Android market on Android Mobile Phones that allow users to report their location to a particular service. Twitter and Layar are two services that allow you to provide your location to their service but they do not always allow third parties to retrieve this information. We decided we needed to create our own service to record locations so that we could have easy access to the data without requiring users to register for another service to record the information. Utilizing our own recording service also allows a seamless integration into our software and event platform.

Chapter 7:
Summary

For the purposes of an art project based in Relational Aesthetics we have created a platform that changes the way that people can interact to both observe art and become a part of it. We show that utilizing a scalable base architecture we have produced a platform that enables live art to be displayed around the world with a simple intuitive interface.

In this thesis, we presented an integrated and scalable platform combining art and technology to enable anyone to successfully produce a live synchronous event with participants and observers spread all over the globe and connected by the internet.

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